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Industrial legislation and contracts

The recycling process in Medstar factory

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الفصل

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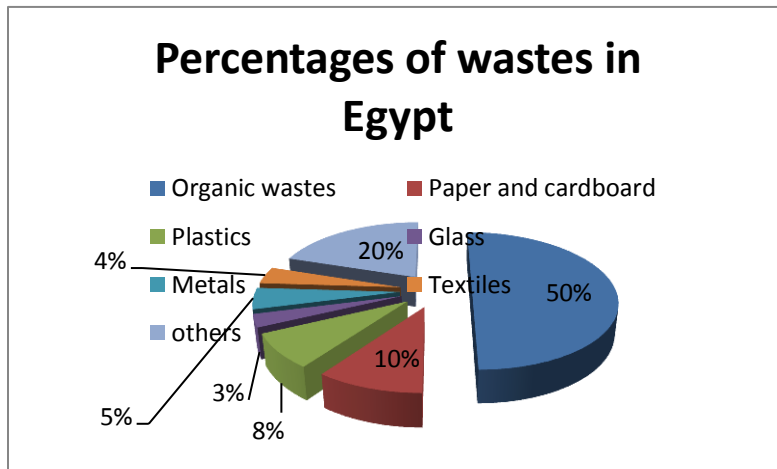
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Abstract:

The recycling has great effects on environment and resources as it preserves the world resources, decreases the costs, decreases the efforts and costs of getting rid of wastes, gives value for no-value products and decreases pollutions. Recycling has several types as paper, plastics, etc.

Wastes percentages in Egypt:



Percentages of plastics in Egyptian market:

Type of raw material	Percentage
LDPE	35.7%
LLDPE	
HDPE	
PE (total)	
PP	23.7%
PET	7.7%
PVC	24.1%
PS	8.8%
	100%

The full recycling line consists of six steps:

- 1- Pre-preparing.
- 2- Preparing.
- 3- Size reduction.
- 4- Blending.
- 5- Compounding.

6- Pelletizing.

Medstar factory specialize in catering tools, kitchen tools, houseware tools, cleaning tools. It contains 3 main lines: Injection molding, filling and mooping and recycling.

Medstar have the ISO (9001 and 14000) certificates by following some precautions as using ear protection, dampers and air ventilating fans.

Introduction:

Recycling: It is a process of reusing, remanufacturing or reclaiming of used products to reduce the consumption of resources.

Recycling includes:

- 1- Reuse of pre-used products in another field or in the same field with lower quality.
- 2- Remanufacturing; to change the shape and function with lower consumption of resources.
- 3- Reclaiming of products by adding raw materials with recyclates; to get products of lower quality but with lower consumption of raw material hence lower costs.

Advantages of recycling:

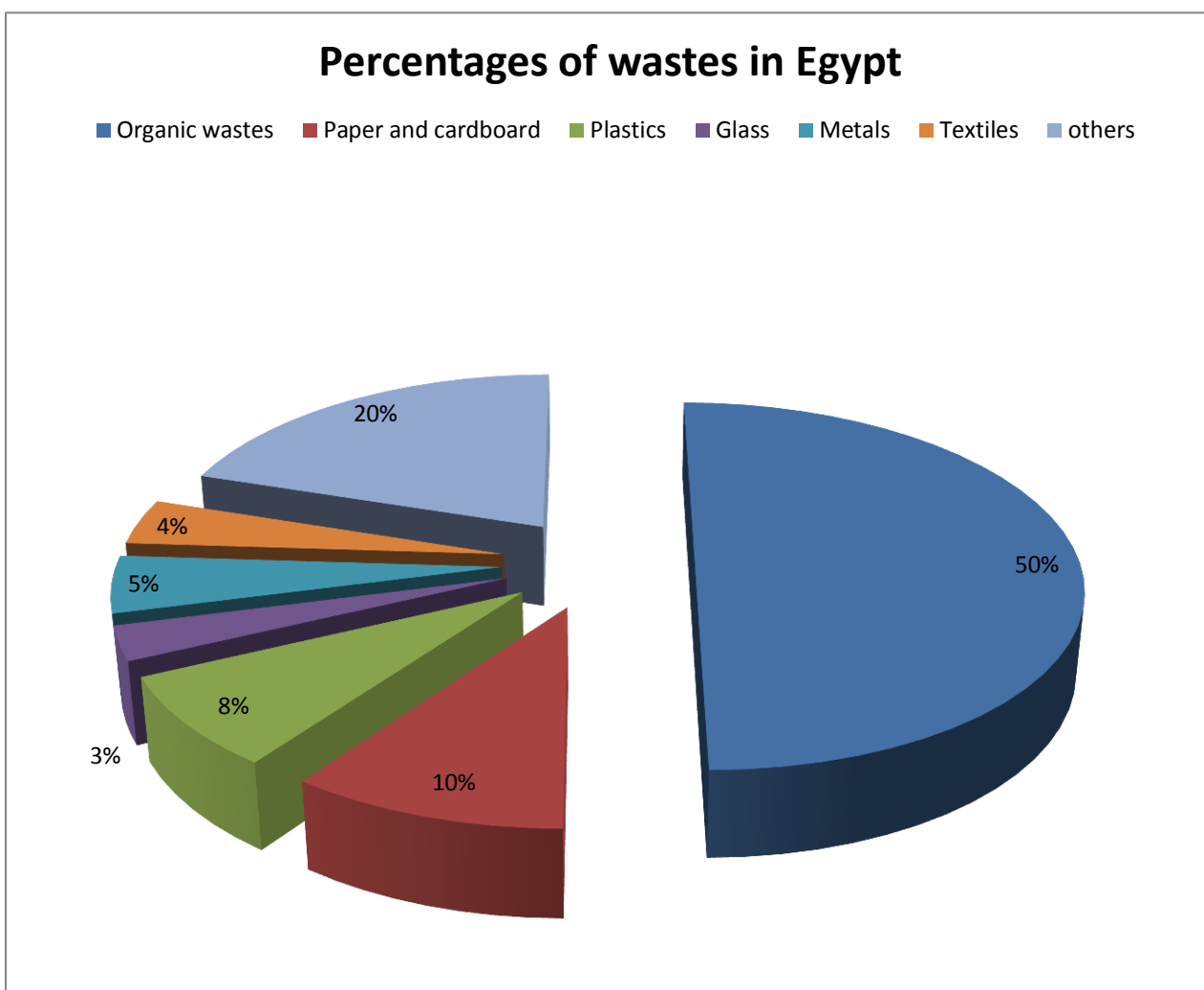
- 1- Preserves the world resources.
- 2- Decreases the costs; due to using smaller amount of raw materials (more expensive).
- 3- Decreases the efforts and costs of getting rid of wastes.
- 4- Give value for no-value products.
- 5- Decreases pollutions.

Types of recycling:

- 1- Plastics.
- 2- Metals.
- 3- Paper.
- 4- Organic wastes.
- 5- Buildings wastes.
- 6- Others.

Percentages of wastes in Egypt:

Type of wastes	Percentage (%)
Organic wastes	50-60
Paper and cardboard	10-25
Plastics	3-12
Glass	1-5
Metals	1.5-7
Textiles	1.2-7
others	11-30



This report concerns with plastics recycling.

Types of recyclable plastics and their applications:

Table 2.3 Common thermoplastics and their applications		
Thermoplastic Polymer	Applications	Lifetime range
HDPE	Packaging, pipes, tanks, bottles, crates	Packaging: 2 years Pipes: 30 years
LDPE	Packaging, grocery bags, toys, lids	Packaging: 2 years
LLDPE	Packaging	2 years
PP	Caps, yoghurt pots, suitcases, tubes, buckets, rugs, battery casings, ropes	Packaging: 2 years Battery casings: 10 years
Polystyrene (PS)	Mass produced transparent articles, yoghurt pots, fast food foamed packaging, cassettes	Packaging: 5 years Cassettes: 10 years
Polyamide* (PA)	Bearings, gears, bolts, skate wheels, fishing lines, carpets, clothing	10 years
Polyethylene terephthalate (PET)	Transparent carbonated drink bottles	5 years
Polyvinyl chloride (PVC)	Food packaging, shoes, flooring	5 years
* Also known as Nylon		

HDPE: High density polyethylene

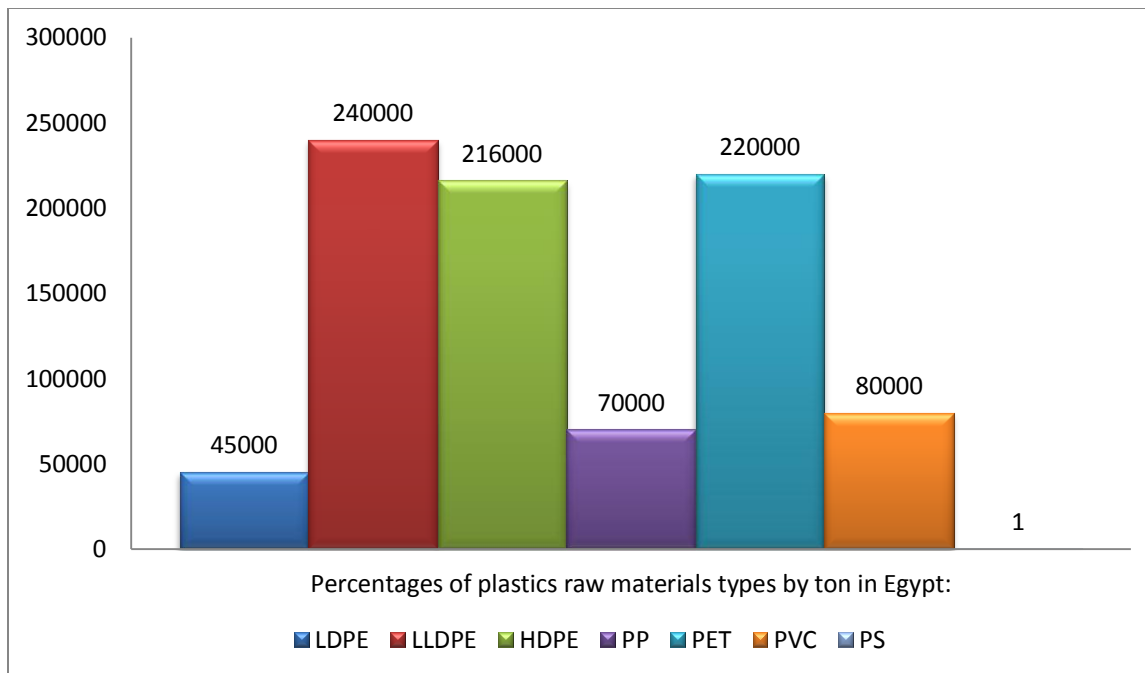
LDPE: Low density polyethylene

PP: Polypropylene

LLDPE : Linear low density polyethylene

Percentages of plastics raw materials types by ton in Egypt:

Type of raw material	Import A	Local production B	Export C	Consumption A+B-C	Percentage
LDPE	45,000	0	0	325,000	35.7%
LLDPE	40,000	0	0		
HDPE	100,000	240,000	100,000		
PE (total)	185,000	240,000	100,000		
PP	85,000	156,000	25,000	216,000	23.7%
PET	70,000	0	0	70,000	7.7%
PVC	160,000	60,000	0	220,000	24.1%
PS	80,000	0	0	80,000	8.8%
Total				911,000	100%



Recycling codes:



The plastics recycling line:

The full plastics recycling line consists of 6 main steps:

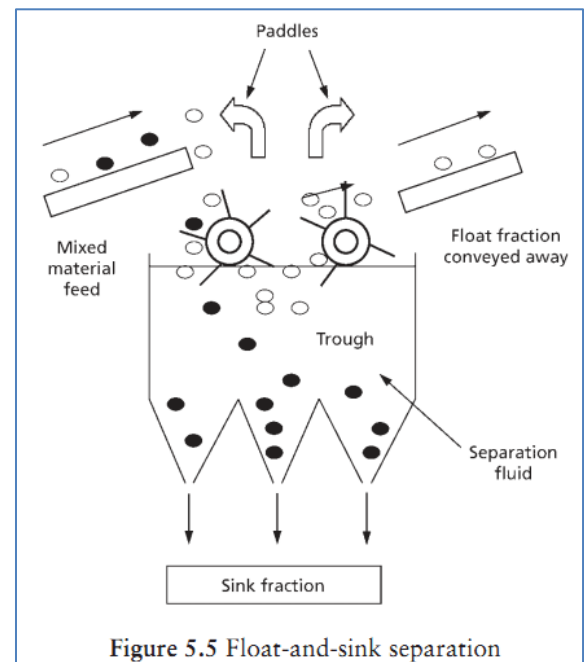
- 1- **Pre-preparing:** It is process for making a batch of plastics as collecting the individual products is too difficult. It consists of 2 steps:
 - A- **Balling:** It is a process special for bags to decrease volume (due to air presence) by pressing them on twins or wires. Compression reaches 10:1.



B- Compacting: It is a process similar to balling but for EPS (Expanded polystyrene) and similar types as a batch

2- Preparing: It is process at which quality is affected to get sorted, cleaned and adequate plastics. It consists of 4 steps:

A- Sorting: For getting high quality plastics and removing wastes, labels, dust, etc. This process has huge field of research including density method, visual method, US waves method and other methods.



B- Sawing: For long products as pipes and hoses

C- Stripping: For bulk products as computers, televisions, etc.

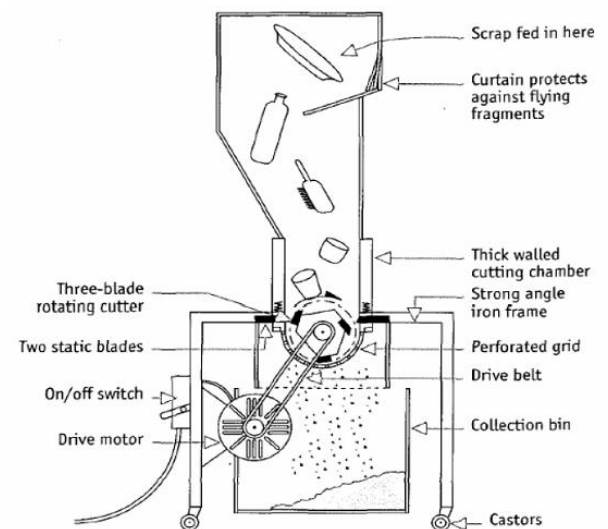
D- Washing and drying: For removing wastes

3- Size reduction: It is a process of reduction of size of plastics from preparing process to facilitate the following processes and allow packaging for transporting. It consists of 2 steps:

A- Crusher (Shredder): It cuts and shreds plastics to sizes reach to 60 mm length.

B- Granulator: It cuts further more from shredding process to get 10 mm length.

- Crusher may perform the 2 processes together.

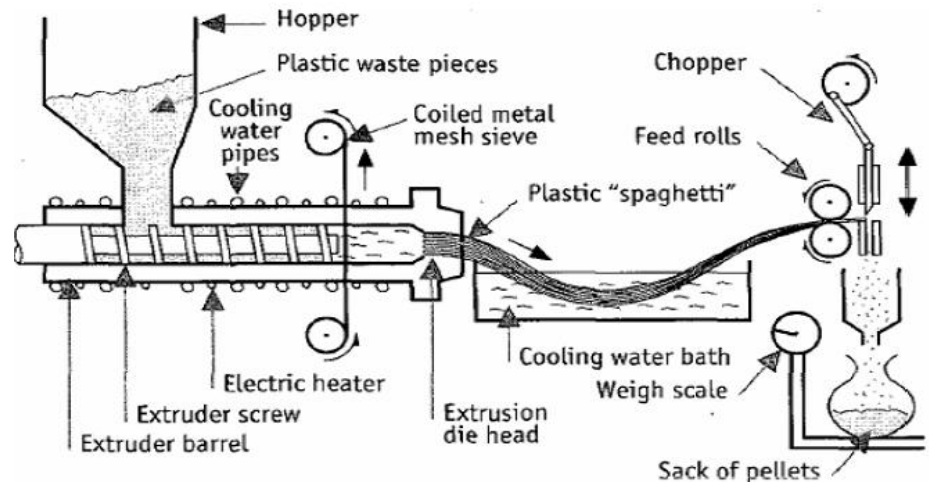


4- Blending: It is a process of mixing to get

homogeneous distribution of several sizes of shredded plastics by adding all types in a vertical screw to stir and mix types. It may contain colour adding process for specific situations.

5- **Compounding**: It is a process of getting homogeneous plastics with certain dimensions suitable for making products processes as injection molding, i.e. granules ,as extrusion with die of diameter of granules.

6- **Pelletizing**: It the process of cutting the long parts to granules of definite lengths suitable for plastics processes.



Case study:

Target:

Recycling line undesired outputs.

Acknowledgements:

Thanks for Medstar-Egypt factory, especially Engineer/ Naguib Saleh for giving us the needed data for this report.

Scope of the factory:

- 1- Catering tools.
- 2- Kitchen tools.
- 3- Houseware tools.
- 4- Cleaning tools.



Manufacturing processes:

The factory contain mainly of 3 portions:

1- **Injection molding**: For making final (one-part) products as plastics chairs, basins...etc.



2- **Filling and mooping**: For making squeegees, moops...etc. used in cleaning.



3- **Recycling**: Due to the presence of parts during manufacturing and don't enter in product, it should be recycled to be sued again instead of craping it as gating system in injection molding.



Gating system produced during injection molding

Used materials:

1- Polypropylene, PP.



Sample of PP raw material used in Medstar

2- Polyethylene. High and low densities, HDPE and LDPE.

3- Fibers of PP.

4- PVC.

The factory lines specifications:

Injection molding line		Filling and mooping line	
Production rate	Scrap percentage	Production rate	Scrap percentage
5 ton daily, 15 machines, 3 shafts	8%	1.5 ton daily, 3 machines, 3 shifts	10%

The present recycling line:

- The factory has a line of crushers in addition to the injection molding and filling-mooping machines.
- Other department has extruder, cooling and pelletizing to get the final recycled plastics granules, used as a ratio with raw material to get product of lower quality (not for food-used products).



Shredder of 200kg/hr present in Medstar for scrap crushing



Shredder of 50kg/hr present in Medstar for scrap crushing



The cutters in the crusher 200kg/hr

The recycling process:

Input	Output	Undesired outputs
Scrap from injection molding processes	Shredded plastics	1- Noises (Most effected factor) 2- Vibrations 3- Dust from process (small plastics parts)

The crushers' ranges (approximately): 5, 30, 100 and 200 kg/hr.

The recycling line and legislations:

The entire factory have the ISO (9001 and 14000) certificates.

As following:

Noises: 100dB.

Vibrations:

- Exposure action value of $0.5 \text{ m/s}^2 \text{ A(8)}$ at which level employers should introduce technical and organizational measures to reduce exposure.
- Exposure limit value of $1.15 \text{ m/s}^2 \text{ A(8)}$ which should not be exceeded.

The used ways to decrease the undesired outputs:

- 1- **For noises:** Ear protection is used to decrease it.



Ear protection as used in Medstar

- 2- **For vibrations:** Dampers are added to machines from rubber.

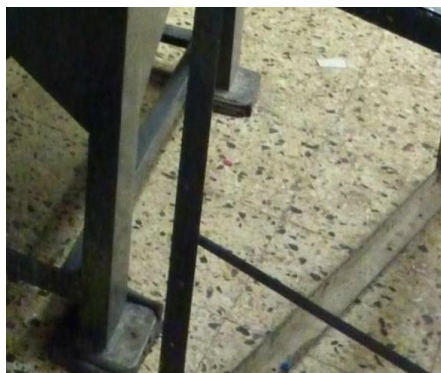


Photo for the base of crusher, rubber is added as a damper

3- *For dust*: Ventilating fans are used.



Ventilating fans as used in Medstar factory

References:

- 1- **Introduction to Plastics Recycling**, Second Edition, 2007, Vannessa Goodship, Smithers Rapra Technology Limited, Shawbury, Shrewsbury, Shropshire, SY4 4NR, United Kingdom.
- 2- **Health and safety executive**: <http://www.hse.gov.uk/index.htm>
- 3- **Green ant plastic recycling**: <http://www.greenantplasticrecycling.co.uk/index.asp>
- 4- **Industrial Modernization Centre (IMC-Egypt)**
- 5- **Medstar-Egypt factory**, 10th October, 2nd manufacturing zone.

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